

A Review of the Genus *Coptocatus* Montandon (Hemiptera: Naucoridae)

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The genus *Coptocatus* has remained obscure since its original description by Montandon (1909). The type species, *C. oblongulus*, was based on three specimens from Borneo, a brachypterous male and macropterous female from “Kina Balu,” and another macropterous specimen from Brunei. The two former specimens, which constitute the types, are now housed in the Riksmuseet, Stockholm; the location of the Brunei specimen is unknown to me. Recent collections in Borneo by the author and J. T. Polhemus, working under a grant from the National Geographic Society, have provided many additional specimens of this genus, including examples of two new species, *C. kinabalu* and *C. tebedu*, described herein. Further material was kindly provided by Gary Hevel from the Smithsonian Institution’s Sabah Project and by George F. Edmunds, Jr. of the University of Utah. The discovery of *C. tebedu* in Sarawak extends considerably the known range of the genus to include the entire mountainous western portion of Borneo.

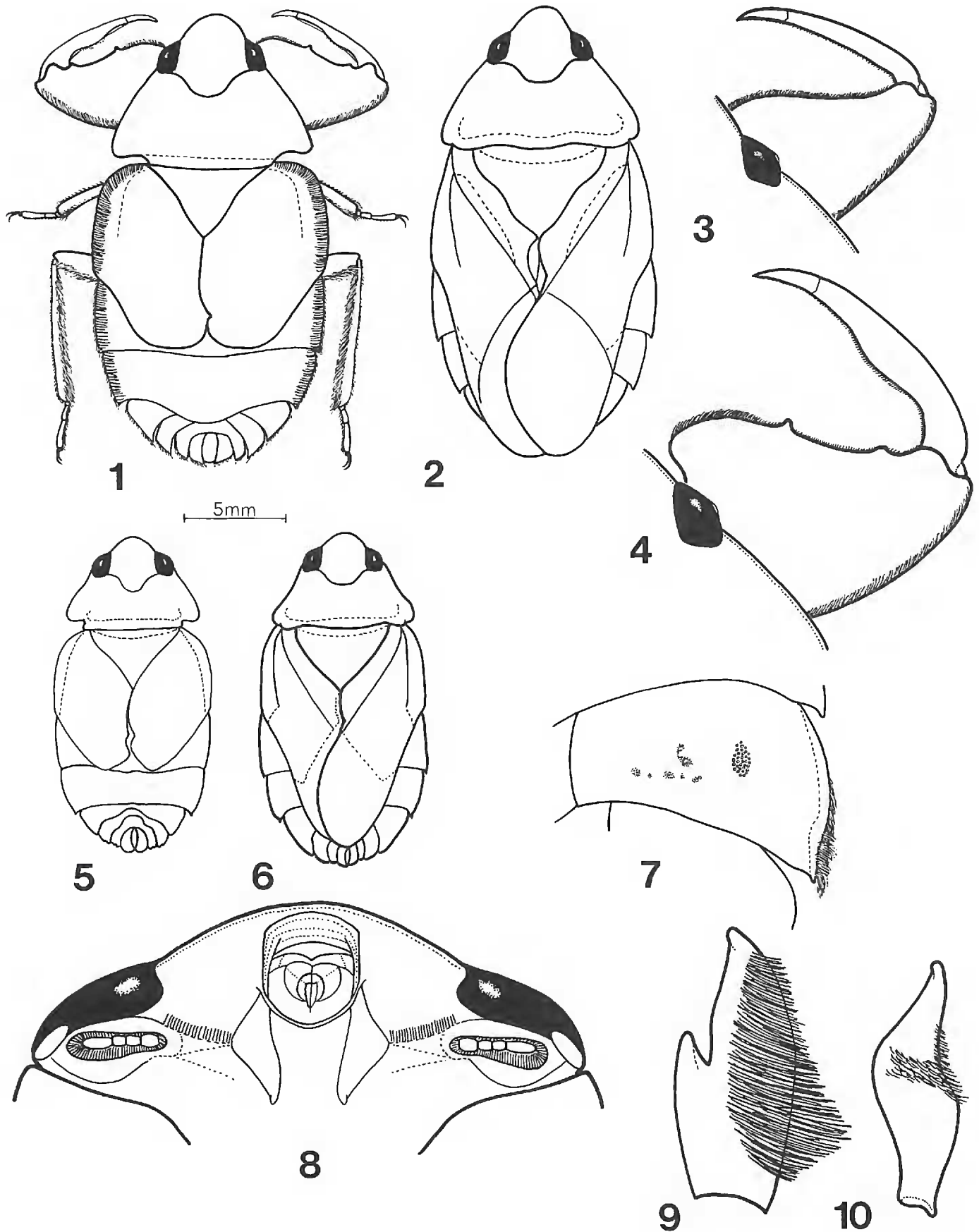
Coptocatus is closely allied to the Indochinese genera *Cheirochela* and *Gestroiella*, the three forming a tight monophyletic unit sharing many synapomorphies. These include antennae recessed into special grooves in the undersides of the eyes, an extremely reduced labrum set in a deep cavity at the base of the rostrum below a greatly produced anteclypeus (see Fig. 8), the apparent fusion of several abdominal sternites and paratergites, and dense hair pads at the apices of the hind and middle tibiae. Montandon established the subfamily Cheirochelinae to hold *Cheirochela* and *Gestroiella* on the basis of material sent to him from Burma by M. L. Fea which he noted “permits the establishment of a new division well characterized by the form of the head and mouthparts and the absence of the labrum, and which tends to draw nearer the Belostomatidae,” and subsequently included *Coptocatus* in the same subgroup (Montandon, 1909). These genera were treated as the tribe Cheirochelini by La Rivers (1971), and are clearly separate as a group from their closest putative relative, the Philippine genus *Asthenocoris* (Usinger, 1938). In fact, considerable morphological evidence exists to suggest that the subfamily Cheirochelinae is polyphyletic, and that the Cheirochelini may have evolved from a laccocorine ancestor far removed from the naucorine lineage that gave rise to the endemic faunas of New Guinea and the Philippines. Montandon’s observation on the similarity of the Cheirochelini to belostomatids is based on superficial aspects of external appearance, but these naucorids are among the largest hemipteran predators in the streams of tropical Asia, frequently exceeding in size species of the belostomatid genus *Diplonychus* with which they are geographically sympatric, and as such represent the largest Naucoridae extant.

Members of the Cheirochelini frequent rushing waters, and may employ some form of plastron respiration, a hypothesis supported by morphological evidence. In *Coptocatus* the majority of individuals are brachypterous, a condition which precludes the maintenance of a subalar air stores like that employed by many other naucorid genera. In addition, the venter lacks a thick hydrofuge pile, bearing instead a very fine, short, closely appressed layer of silvery hairs, interrupted along the lateral portions of the paratergites by glabrous areas bearing complex structures of an apparently sensory nature (see Fig. 7). These "sense organs" consist of roughly ovate to circular depressions set with numerous minute shining foveae, and are similar to structures observed in the New Guinea genus *Idiocarus* Montandon. In the latter taxon the venter is set with a thick, recumbent gold hair pile, and the "sense organs" are visible as ovate depressions of different reflectivity present laterally on the abdominal paratergites and on the prothorax. Structures of this type and location in the Neotropical genus *Cryphocricos* were judged by Parsons and Hewson (1974) to represent static sense organs, helping to keep the insects correctly oriented in the stream in the absence of a dorsal air store; a similar function would also appear likely in the case of *Coptocatus* and *Idiocarus*. The structure and function of such sense organs has been extensively documented for the genus *Aphelocheirus*, species of which employ sophisticated plastron respiration (Thorpe and Crisp, 1947a, 1947b, 1947c).

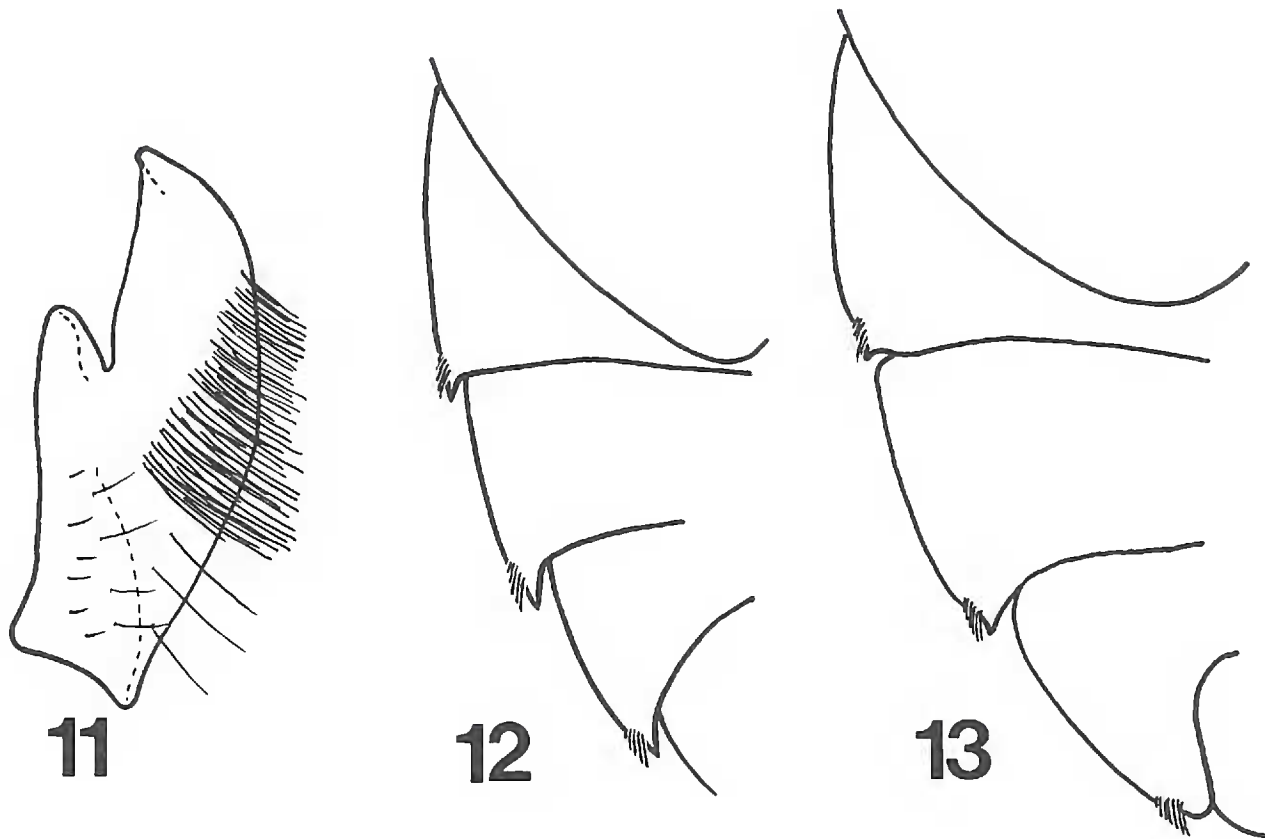
I thank Gary Hevel of the Smithsonian Institution for the opportunity to examine specimens collected by that institution's Sabah Project and George F. Edmunds, Jr. of the University of Utah for the gift of *Coptocatus* collected by himself, C. H. Edmunds, W. G. Peters and J. L. Peters in the course of mayfly research supported by the National Science Foundation and the National Geographic Society. Also special thanks to P. Lindskog of the Riksmuseet, Stockholm for the loan of the types of *C. oblongulus*. All specimens treated herein are held in the following collections: United States National Museum, Washington, D.C. (USNM); Naturhistoriska Riksmuseet, Stockholm (NHRM); J. T. Polhemus Collection, Englewood, Colo. (JTPC). Types are deposited in the USNM. All measurements are given in millimeters. This research was supported in part by a grant from the National Geographic Society, Washington, D.C.

KEY TO THE SPECIES OF *COPTOCATUS* MONTANDON

- 1a. Overall length 17 mm or greater (see Figs. 1, 2); male fore femur frequently bearing one or two toothlike projections on anterior face adjoining tibia (see Fig. 4); male parameres bidentate (see Fig. 9) . . . *C. kinabalu*, n. sp.
- b. Overall length 15 mm or less (see Figs. 5, 6); male fore femur lacking toothlike projections; male parameres either bidentate or tapering . . . 2
- 2a. Posterolateral angles of abdominal segments II and III (at least) strongly produced and spinose (see Fig. 12); male parameres bidentate (see Fig. 11) *C. tebedu*, n. sp.
- b. Posterolateral angles of abdominal segments II and III not strongly produced, at most weakly spinose (see Fig. 13); male parameres not bidentate, tapering to rounded tips (see Fig. 10) *C. oblongulus* Montandon



Figures 1–10. *Coptocatus* sp. Scale bar provided for habitus figures only. 1. *Coptocatus kinabalu*, n. sp., habitus, brachypterous male. 2. *Coptocatus kinabalu*, n. sp., habitus, macropterous male, legs and setiferation omitted. 3. *Coptocatus kinabalu*, n. sp., detail of female foreleg. 4. *Coptocatus kinabalu*, n. sp., detail of male foreleg. 5. *Coptocatus oblongulus* Montandon, habitus, brachypterous male type specimen, legs and setiferation omitted. 6. *Coptocatus oblongulus* Montandon, habitus, macropterous female, legs and setiferation omitted. 7. *Coptocatus kinabalu*, n. sp., detail of ventral surface of abdominal paratergite V showing locations of sensory organs and spiracle. 8. *Coptocatus oblongulus* Montandon, ventral view of head showing location of maxillary plates, recessed antennae, and rostral cavity. 9. *Coptocatus kinabalu*, n. sp., male left paramere. 10. *Coptocatus oblongulus* Montandon, male left paramere.



Figures 11–13. *Coptocatus* sp. 11. *Coptocatus tebedu*, n. sp., male left paramere. 12. *Coptocatus tebedu*, n. sp., detail of abdominal margin showing tergites II–IV. 13. *Coptocatus oblongulus* Montandon, detail of abdominal margin showing tergites II–IV.

Coptocatus oblongulus Montandon

Coptocatus oblongulus Montandon, 1909, Bull. Soc. Sci. Buch., 18:45.

This species may be recognized by its small size (see Figs. 5, 6), by its nonspinose posterolateral abdominal angles (see Fig. 13), and by its distinctively shaped male parameres (see Fig. 10) which, as in all the Cheirochelini, are symmetrical. I have examined the two type specimens housed in the Riksmuseet, Stockholm, a macropterous female and a brachypterous male. Both specimens are in excellent condition, and bear the following labels; “Borneo, Kina Balu” (printed); “*Coptocatus oblongulus* Montandon, type 1908” (in Montandon’s writing, with type designation in red and note “brachyptr.” or “macroptr.” on appropriate specimen); “Typus” (printed label on red paper); “441 64” (on red paper, first number printed, second number written); “1 85” (on brachypterous specimen) or “2 85” (on macropterous specimen; both labels on red paper, with first number printed and second number written); “Riksmuseum, Stockholm” (on green paper). Since no single type is indicated, these specimens represent cotypes, and the brachypterous male is hereby designated lectotype.

Specimens taken by the author and by the Edmunds and Peters group on the Liwagu River near Mt. Kinabalu match the type specimens very well, including the particulars of the male genitalia. On the types the legs are dull brown, while those of the more recent specimens are pallid to white, but this is likely an artifact due to preservation method or aging. This species has been taken through a considerable range of elevations, from the low forests at Ranau where the river was over 50 meters wide to the headwaters near Liwagu Cave where the width was barely 5 meters. In all cases the insects preferred a rocky bed with a moderate

but not rushing current and were most often taken from among substrates of coarse gravels overlain by moderate sized rocks.

Material examined.—BORNEO, Malaysia, Sabah: 2 macropterous males, 3 brachypterous males, 2 macropterous females, 3 macropterous females, 11 nymphs, Liwagu River at bridge, Ranau, S4e, 335 m, VIII-16-72, G. F. and C. H. Edmunds, W. L. and J. G. Peters (JTPC); 4 macropterous males, 2 macropterous females, Liwagu River N of Kundassan, S8, 915 m, VIII-16-72, W. L. and J. G. Peters (JTPC); 1 macropterous male, Liwagu River at Liwagu Cave, SE of Headquarters, S7e, 1525 m, VIII-14-72, G. F. and C. H. Edmunds (JTPC); 2 brachypterous females, 2 nymphs, Mantukungan River, S of Poring Hot Springs, S6, 365 m, VIII-12-72, W. L. and J. G. Peters (JTPC); 1 macropterous female, 16 km E of Ranau, VIII-14-83, G. F. Hevel and W. E. Steiner (USNM); 11 macropterous males, 6 macropterous females, 1 brachypterous female, 17 nymphs, Liwagu River at Kundassan, VIII-1-85, CL 2021, D. A. and J. T. Polhemus (JTPC); 1 macropterous male, 13 brachypterous males, 13 brachypterous females, 16 nymphs, stream 1 km S of Poring Hot Springs, VIII-2-85, CL 2023, D. A. and J. T. Polhemus (JTPC); 1 macropterous male, 1 brachypterous male, 2 macropterous females, 1 brachypterous female, 1 nymph, Sungai Samalang, 7 km S of Ranau, VIII-3-85, CL 2026, D. A. and J. T. Polhemus (JTPC); 3 brachypterous males, Sungai Nukakatan trib., 26 km S of Ranau, VIII-3-85, CL 2028, D. A. and J. T. Polhemus (JTPC).

Coptocatus kinabalu D. Polhemus, NEW SPECIES

Brachypterous male.—Large, robust, highly streamlined and dorsoventrally flattened (see Fig. 1), general coloration dark brown. Overall length 19–21 mm; maximum width (across base of abdomen) 10–11 mm.

Head brown, shining, anterior margin along anteclypeus infuscated, width/length = 5.3/4.5; anteclypeus greatly produced, apex evenly rounded, projecting beyond rostrum for a distance greater than exposed rostral length when viewed laterally; eyes black, convex, roughly quadrate, width/length = 1.0/1.8, raised above level of vertex and separated from it by wide, shallow sulci, lateral margins bearing a weakly developed flange; anterior/posterior interocular 3.3/3.5; vertex greatly produced posteriorly, extending rearward for over 0.5 the length of an eye. *Pronotum* brown, shining, width/length (midline) = 10/3.4; lateral margins with narrow raised black ridge, posterolateral angles acute, rounded. *Scutellum* yellowish brown, shining, width/length = 6.0/3.0, anterior margin strongly reflexed downward. *Hemelytra* dark brown, brachypterous, extending only to posterior margin of abdominal tergite II, tips broadly rounded, surface set with fine pale granular microstructure, embolium weakly defined, explanate, set with long recumbent black setae; hemelytral commissure with small projecting tooth on left hemelytron distally, fitting into corresponding indentation on right hemelytron. *Abdomen* with tergites II–VIII exposed, dark brown, lighter laterally, surface set with closely appressed black setae; posterolateral angles of segments III–VII acutely spinose, angles on segments III–VIII with long rearwardly projecting hair tufts. *Ventral surface* reddish brown, covered with very fine, closely appressed silvery hairs, head glabrous, yellowish to greenish; rostrum set into deep well behind projecting anteclypeus, tip brown, glabrous; labrum greatly reduced, barely evi-

dent, set into roof of rostral cavity; maxillary plates oriented horizontally, flush with bottom of head capsule; two (1 + 1) rows of raised brown setae present running from bases of maxillary plates to bases of antennae; antennae thick, four segmented, segment I larger in diameter than segments II–IV, segment IV longest, set into deep groove below eyes lined with fine gold setae; head behind eye weakly carinate medially. Prosternum with distinct carina anteromedially between fore coxae, proepisternal plates clearly visible, triangular, posterior margins reflexed downward to form hair lined pits adjoining mesosternum, proepimeron with tiny shining pit-like structures present below fore coxal cavity; mesosternal plate gently raised with a weak furrow medially, tip produced to an acute point caudad; metasternal plate barely visible, acarinate; undersurface of wing embolium with tiny shining pit-like structures present near anterior angles. Abdominal venter with extremely fine covering of short recumbent silvery hairs, paratergites on segments III and IV (second and third visible, respectively) fused to sternites, sutures lacking; paratergites II–VII with ovate areas of tiny shining pit-like structures laterally; spiracles present as semicircular depressions; rows of irregular glabrous depressions present behind spiracles, running roughly parallel to posterior paratergal margins (see Fig. 7); sternites IV and VII with posteriorly directed gold hair tufts present medially on posterior margins; sternites V and VI fringed with gold setae on posterior margins; genital segment glabrous, bearing gold setae distad; entire abdominal venter microscopically roughened and pruinose, lateral margins narrowly glabrous. *Legs* yellowish brown, fore tibiae and coxae reddened; fore coxae, trochanters and femora massive, fore femur bearing up to two stout protruding teeth along anterior margin (see Fig. 4), posterior margin bearing fringe of long gold setae; anterior face of fore trochanter and femur and adjoining face of fore tibia set with short stiff gold setae; fore tibia weakly curved, inner margin frequently sinuate in larger individuals, fore tarsus barely delineated, claw single, blunt, obscure. Middle and hind coxae yellowish, recessed into ventral body surface, ventral faces concave; middle and hind trochanters glabrous, middle femur slender, bearing longitudinal row of fine raised gold setae along posterior margin; middle tibia with about thirty transverse rows of four to six stout reddish spines present along anterior margin, posterior margin with about fifteen similar but smaller transverse spine rows and a thick margin of long gold setae; posterior femur set with long black swimming hairs along posterior margin; posterior tibiae thickly set with short reddish spines along anterior margin, posterior margin with long black swimming hairs; middle and posterior tibiae bearing thick pads of posteriorly directed gold hairs apically on ventral face and a transverse row of short reddish spines apically along inner margin; middle and hind tarsi three segmented, distal segment as long as basal two combined, all segments set with short spines ventrally, hind tarsi also with gold setae on ventral face; parempodia setiform; claws bent sharply apically, tips infuscated, blunt. *Male parameres* symmetrical, bidentate shape as in Figure 9, set with a comb of long setae. *Vessica* lightly and symmetrically sclerotized, terminal lobe large, membranous, bluntly rounded.

Brachypterous female. — Similar to male in general structure, but not nearly so massive, form narrower, length 20.0–17.5 mm; maximum width 10.0–9.0 mm. Fore femora not armed with teeth on anterior margins (see Fig. 3), fore tibiae

slender, inner margins not sinuate. Subgenital plate roughly trapezoidal, widened basally, tip rounded.

Macropterous male.—Form more elongate than brachypter, with wings fully developed and extending beyond tip of abdomen (see Fig. 2). Length 20.0 mm; maximum width (across wing embolia) 9.50 mm. Pronotum more massive, posterolateral angles more rounded, less acute, a weak sulcus present adjoining posterior margin; scutellum raised, bearing a transverse carinate ridge behind anterior margin; wings with clavus, embolium, and membrane well defined, brown, membrane dark brown to blackish; entire dorsal surface set with pale granular microstructure; small sclerotized plate present at anterolateral margin of clavus.

Material examined.—Holotype, male, and allotype: BORNEO, Malaysia, Sabah, 17 km S of Keningau, VIII-31-83, G. F. Hevel and W. E. Steiner (USNM). Paratypes as follows: BORNEO, Malaysia, Sabah: 2 brachypterous males, 4 brachypterous females, same data as types (USNM, JTPC); 1 brachypterous female, 11 km E of Donggongon, IX-3-83, G. F. Hevel and W. E. Steiner (USNM); 1 brachypterous male, Apin Apin, IX-2-83, G. F. Hevel and W. G. Steiner (USNM); 2 brachypterous males, 17 km E of Donggongon, IX-4-83, G. F. Hevel and W. G. Steiner (USNM); 3 brachypterous males, 2 brachypterous females, 3 nymphs, 10 km SW of Tambunan, IX-2-83, G. F. Hevel and W. G. Steiner (USNM, JTPC); 1 macropterous male, 2 nymphs, Paginatan, VIII-18-83, G. F. Hevel and W. E. Steiner (USNM); 1 macropterous male, 1 brachypterous female, 11 nymphs, tributary of Sungai Moyog, 3 mi E of Penampung, X-2-78, G. F. and C. H. Edmunds (JTPC); 1 nymph, Mansuncun River, NE of Kota Kinabalu, 300 m, VIII-18-72, G. F. and C. H. Edmunds (JTPC); 1 macropterous male, 1 brachypterous male, 1 brachypterous female, 12 nymphs, Sungai Nukakatan, 26 km S of Ranau, VIII-3-85, CL 2028, D. A. and J. T. Polhemus (JTPC).

Remarks.—*C. kinabalu* may be easily recognized by its large size, massively developed male forelegs, and male genital structures. By far the biggest naucorid in Borneo, and one of the largest in the world, this species frequents open rocky mountain rivers where it is found in areas of swift smooth current amid fist to head sized rocks. Although its range is sympatric with that of *C. oblongulus* Montandon, the two species appear to segregate habitats on the basis of stream size. At the Sungai Nukakatan, for instance, *C. kinabalu* was present in the large main river but not in a small side tributary, where *C. oblongulus* occurred instead. The habitat partitioning between these two species would provide an interesting study for aquatic ecologists.

Etymology.—The name “kinabalu” is a noun in apposition and refers to Mt. Kinabalu, the highest mountain in Borneo, from the vicinity of which all known examples of this species have come.

Coptocatus tebedu D. Polhemus, NEW SPECIES

Brachypterous male.—Small for genus, general coloration dull brown, becoming yellowish on head, pronotum, and scutellum. Overall length 13–14 mm; maximum width (across base of abdomen) 7 mm. *Head* yellowish brown, anterior margin black, width/length = 3.33/2.63, anteclypeus highly produced, apex evenly rounded, projecting far beyond base of rostrum; eyes black, convex, width/length = 0.76/1.06, separated from vertex by shallow sulci, lateral flange barely

evident; anterior/posterior interocular = 1.87/2.02; vertex greatly produced posteriorly, extending back for over 0.7 the length of an eye. *Pronotum* yellowish brown, darker behind eyes, width/length = 5.56/1.72, lateral margins with narrow raised lip, posterolateral angles acute, rounded, posterior margin infuscated, delineated by distinct transverse sulcus. *Scutellum* yellowish brown, with darker muscle attachment scars to either side of midline, width/length = 3.69/2.12, strongly depressed along anterior margin, lateral margins weakly sinuate. *Hemelytra* dark brown, brachypterous, not attaining posterior margin of abdominal tergite II, tips broadly rounded, surface minutely roughened, embolium weakly defined, explanate, lateral margin raised, black, set with long recumbent pale setae; hemelytral commissure with small projecting tooth on left hemelytron distally, fitting into corresponding indentation on right hemelytron. *Abdomen* with tergites II–VIII exposed, brown, yellowish laterally, set with closely appressed fine black setae except on areas adjoining lateral margins, posterolateral angles of segments II–IV sharply produced, spinose, those of segments V–VII rounded, all segments bearing fringe of long pale recumbent setae along lateral margins and tufts of stout setae at posterolateral angles. *Ventral surface* reddish brown, covered with very fine closely appressed silvery setae on abdomen, head yellowish; rostrum set into deep cavity below anteclypeus, yellowish, tip infuscated, glabrous; labrum extremely reduced, set anteriorly into roof of rostral cavity, brown; maxillary plates horizontal, triangular, pale; two (1 + 1) rows of raised brown setae running from bases of maxillary plates to bases of antennae; antennae thick, four segmented, pale, set into grooves beneath eyes, segment IV as long as segments II and III combined. Prosternum lightly pruinose, with distinct raised black carina anteromedially between forelegs, proepisternal plates well exposed, triangular, dipping posteriorly to form two pits adjoining mesosternal plate set with tufts of gold setae; mesosternal plate pruinose, with numerous irregular ovate glabrous areas scattered along anterior margin, weak longitudinal sulcus present medially, anterior margin weakly reflexed medially, posterior margin produced to an acute point; mesosternal plate small, acarinate, posterior margin with gold setae. Abdominal venter with typical sense organs and spiracular modifications as described in previous species, paratergites on segments III and IV (second and third visible) fused to sternites, sutures lacking; lateral margins of paratergites glabrous, infuscated, bearing tufts of gold setae at posterolateral angles; sternites IV and VI–VII with tufts of setae medially; genital segment brown, glabrous, set with gold setae. *Legs* pallid to yellowish, fore femur with row of long recumbent gold setae on posterior margin and pad of thick short gold setae on anterior margin; fore tibia brown, gently curved, inner margin occasionally sinuate, fore tarsus with single segment bearing single blunt claw; middle and hind coxae pale, concave on ventral faces; middle and hind trochanters pale, glabrous; middle femur slender, with longitudinal row of gold setae along hind margin; middle tibia with transverse rows of spines on anterior and posterior margins, long gold setae present along posterior margin; hind femur and tibia with long gold setae along posterior margins, tibia with reddish spines on anterior face; middle and hind tibiae bearing thick gold hair pads and transverse rows of reddish spines apically; middle and hind tarsi three segmented, distal segment longest, all segments with short spines ventrally, hind tarsi with gold setae on ventral face; parempodia setiform; claws

black, sharply bent, blunt. *Male parameres* symmetrical, bidentate, shape as in Figure 11, bearing a comb of long setae; *vessica* lightly and symmetrically sclerotized, terminal lobe squared off apically.

Brachypterous female. — Similar to male in general structure and coloration, but form slightly more elongate, length 14.0–14.5 mm; maximum width 6.9–7.0 mm. Posterolateral angles of abdominal segments II–V produced and spinose, raised patches of setae present medially on abdominal sternites IV–VI. Subgenital plate trapezoidal, widened basally, bearing transverse rows of fine setae, a tuft of longer setae present medially near tip, posterior margin evenly rounded, fringed with long gold setae.

Macropterous form. — Unknown.

Material examined. — Holotype, male, and allotype: BORNEO, Malaysia, Sarawak, Tebedu, SE of Kuching, shallow rocky river, VIII-9-85, CL 2048, D. A. and J. T. Polhemus (USNM). Paratypes: 25 brachypterous males, 23 brachypterous females, 17 nymphs, same data as types (JTPC).

Remarks. — *C. tebedu*, n. sp. may be recognized by its small size, spinose posterolateral abdominal angles (see Fig. 12), and bidentate male parameres (see Fig. 11). Although the parameres are quite similar to those of *C. kinabalu*, that species is much larger and more robust, so that its size and habitus alone are sufficient to prevent confusion. The type series of *C. tebedu* was taken in a swift, shallow, unshaded river flowing in a bed of sand and cobbles. The type locality is less than ten kilometers from the Indonesian frontier, and this species undoubtedly occurs in the biologically unexplored mountains of Kalimantan.

Etymology. — The name “tebedu” is a noun in apposition and refers to the name of the type locality.

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